WHAT IS CLAIMED IS:

1. A substrate having optical and electrical interconnections, comprising:

a first layer having polymeric waveguides formed therein;

a second layer having polymeric waveguides formed therein;

a first vertical optical coupler formed in said first layer and optically coupled to a first waveguide in said first layer;

a second vertical optical coupler formed in said second layer and optically coupled to a second waveguide in said layer;

wherein said first optical coupler is positioned adjacent said second vertical optical coupler so that light may be coupled between said first and said second waveguides.

2. The substrate of Claim 1 wherein at least a portion of said substrate is formed by a build-up process.

3. The main substrate of Claim 1 wherein at least a portion of said substrate is formed by a lamination process.

4. The main substrate of Claim 1 further comprising:

at least one additional layer having polymeric waveguides formed therein;

an additional vertical optical coupler formed in said at least one additional layer and optically coupled to a waveguide in said at least one additional layer;

wherein said layers are stacked face-to-face and are optically coupled by said vertical optical couplers.

5. The substrate of Claim 4, wherein at least a portion of said substrate is formed by a build-up process.

6. The substrate of Claim 4, wherein at least a portion of said substrate is formed

by a lamination process.

7. The substrate of Claim 1 wherein said vertical optical couplers are coated with anti-reflective layers.

8. The substrate of Claim 1 wherein external light is coupled to a waveguide in at least one of said layers using an optical connector selected from the group consisting of optical fibers, film waveguide arrays, image guides, or fiber arrays.

9. The substrate of Claim 1 wherein at least one waveguide in said first layer has a first portion whose length is parallel to the first layer's surfaces, and a second portion whose length is perpendicular to the first layer's surfaces, wherein each waveguide portion has a first end and a second end, wherein the first ends of said waveguide portions are optically coupled to one of said vertical optical couplers, and wherein the second end of said second waveguide portion extends to a surface of said first layer.

10. The substrate of Claim 1 wherein said first layer has waveguides integrally formed with a plurality of opto-electronic devices.

11. The substrate of Claim 10 wherein at least a portion of said substrate is formed by a build-up process.

12. The substrate of Claim 10 wherein at least a portion of said substrate is formed by a lamination process.

13. The substrate of Claim 10, wherein external light is coupled to a waveguide in at least one of said layers using an optical connector selected from the group consisting of optical fibers, film waveguide arrays, image guides, or fiber arrays.

14. The substrate of Claim 4 wherein at least one of said layers has a plurality of waveguides which are integrally formed with a plurality of opto-electronic devices.

15. The substrate of Claim 14 wherein at least a portion of said substrate is formed by a build-up process.

16. The substrate of Claim 14 wherein at least a portion of said substrate is formed by a lamination process.

17. The substrate of Claim 14, wherein external light is coupled to a waveguide in at least one of said layers using an optical connector selected from the group consisting of optical fibers, film waveguide arrays, image guides, or fiber arrays.

18. The substrate of Claim 10 wherein at least one waveguide in one of said layers has a first portion whose length is parallel to the layer's surfaces, and a second portion whose length is perpendicular to the layer's surfaces, wherein each waveguide portion has a first end and a second end, wherein the first ends of said waveguide portions are optically coupled to one of said vertical optical couplers, and wherein the second end of said second waveguide portion extends to a surface of said layer.

19. A substrate having optical and electrical interconnections, comprising:

a first polymer layer having polymer waveguides formed therein; and

a second polymeric layer having a plurality of optoelectronic devices integrally formed therein;

wherein the layers are laminated to one another to form a stack of layers.

20. The substrate of Claim 19 wherein at least one of the opto-electronic devices is selected from the group consisting of a VCSEL, a VCSEL with driver circuit, a photodetector, a photodetector with amplifier circuit, a light modulator, an optical switch,

a lens, a mirror, a LED, a light amplifying film, a semi-transparent mirror, a grating, a high refractive index element, a driver chip, and amplifier chip, a wavelength filter, a tunable filter, a wavelength converter, a resistor, a capacitor, a mini-chip, and a waveguide.

21. The substrate of Claim 19 wherein the opto-electronic device includes a driver for a VCSEL.

22. The substrate of Claim 19 wherein the opto-electronic device includes at least one photodetector and at least one pre-amplifier.

23. The substrate of Claim 22 further comprising a resistor coupling the output of said amplifier to said photodetector.

24. The substrate of Claim 19 further comprising a photodetector and a resistor coupled the output of said photodetector.

25. The substrate of Claims 19 wherein the polymeric waveguide layer comprises multiple dielectric layers.

26. The substrate of Claim 19 further comprising:

a third polymeric layer having a plurality of electronic integrated circuit chips integrally formed therein; and

wherein the layers are laminated to one another to form a stack of layers.

27. The substrate of Claim 26 wherein at least one of the opto-electronic devices comprises at least one of the following devices: a VCSEL, a VCSEL with driver circuit, a photodetector, a photodetector with amplifier circuit, a light modulator, an optical switch, a lens, a mirror, a LED, a light amplifying film, a semi-transparent mirror, a grating, a

high refractive index element, a driver and amplifier chip, optical amplifier, wavelength filter, tunable filter, wavelength converter, resistor, capacitor, mini-chip, and a waveguide.

28. The substrate of Claim 27 wherein the opto-electronic device comprises a VCSEL and a driver circuit.

29. The substrate of Claim 26 wherein the opto-electronic devices comprises a photodetector with an amplifier.

30. The substrate of Claim 29 further comprising a resistor coupling the input of said amplifier to said photodetector.

31. The substrate of Claim 27 wherein the electronic integrated circuit chips comprises at least one of a driver for a VCSEL and an amplifier for a photodetector.

32. The substrate of Claim 26 wherein one of said opto-electric devices comprises a photodetector, and wherein said substrate further comprising a resistor which couples a pad of an electronic integrated circuit chips to said photodetector.

33. The substrate of Claim 19 wherein at least a portion of the substrate is formed by a build-up process.

34. A substrate comprising:

a first board with vertically oriented optical switch devices and micro-lenses disposed at their optical outputs;

a second board with vertically oriented photo-detector devices and micro-lenses disposed at their optical inputs; and

wherein the boards are disposed opposite to one another so that corresponding

switch devices and photo-detector devices are aligned to one another.

35. An optical interconnect system for communicating information between a plurality of chips, comprising:

a first opto-electronic multichip module having a top surface for mounting chips and a bottom film layer with at least one waveguide configured to couple optical signals into and out of said opto-electronic multi-chip module;

a second opto-electronic multichip module having a top surface for mounting chips and a bottom film layer with at least one waveguide configured to couple optical signals into and out of said opto-electronic multi-chip module;

at least one passive film with an optical waveguide layer disposed proximate said bottom surfaces of said first and second multi-chip modules and coupling optical signals between said first and second multi-chip modules.

36. The optical interconnect system of Claim 35, where said opto-electronic multichip modules comprise a stack of at least two film layers.

37. The optical interconnect system of Claim 36, wherein at least one of the film layers is a passive waveguide film and the other film is an active device film having detectors, and light emitters and/or light modulators.

38. The optical interconnect system of Claim 36, wherein one of the film layers is an electrical layer.

39. The optical interconnect system of Claim 35, further comprising a passive optical backplane waveguide layer to optically couple eletro-optic multichip modules disposed on opposite sides of said backplane waveguide layer.

40. The optical interconnect system of Claim 35, further comprising a passive

optical motherboard waveguide layer to optically couple eletro-optic multichip modules disposed on opposite sides of said motherboard waveguide layer.

41. An electro-optic module for communicating optical signals between at least two electrical circuit terminals, comprising:

at least one substrate, wherein each substrate is selected from the group consisting of substrates with passive polymer waveguides, substrates with electro-optic elements embedded in a polymer film, substrates having embedded electrical elements, and substrates having passive polymer waveguides and embedded electrical and electro-optic elements;

optical waveguide means in at least one of the substrates for propagating optical signals;

optical signal source means in at least one of the substrates for generating optical signals in at least one of the substrates; and

optical detection means in at least one of the substrates for detecting optical signals.

42. The module of Claim 41, further comprising:

stack optical waveguide coupling means to communicate optical signals between said plurality of substrates.

43. The module of Claim 41, further comprising:

at least one electrical board; and

via means for making electrical connections.

44. The module of Claim 41, further comprising: flexible coupling means for coupling optical energy to at least one waveguide of a substrate containing waveguides.

45. An electro-optic module for communicating optical signals between at least

two electrical circuit terminals, comprising:

at least one substrate, wherein each substrate is selected from the group consisting of substrates with passive polymer waveguides, substrates with electro-optic elements embedded in a polymer film, substrates having embedded electrical elements, and substrates having passive polymer waveguides and embedded electrical and electro-optic elements;

optical waveguide means in at least one of the substrates for propagating optical signals;

optical switch means in at least on of the substrates for switching optical power or an optical signal in at least one of the substrates.

46. The module of Claim 45, further comprising:

stack optical waveguide coupling means to communicate optical signals between said plurality of substrates.

47. The module of Claim 47, further comprising:

at least one electrical board; and

via means for making electrical connections.

48. The module of Claim 45, further comprising: flexible coupling means for coupling optical energy to at least one waveguide of a substrate containing waveguides.

49. A method of making a substrate comprising the steps of:

separately manufacturing waveguide layers, IC chip layers, and opto-electric layers, each layer having at least one electrical via formed therein; and

laminating the layers together such that at least one electrical connection is made between two different layers, and such that the end of a waveguide in one layer is aligned to an opto-electric device in an adjacent layer.